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UNION
COLLEGE
AERO
DESIGN
TEAM

TELEMETRY SYSTEM V2.0: THE HORNET USER MANUAL

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Parts List:

A log of photographs for each part can be seen in Appendix.

- 1) Arduino Mini Pro Board
- 2) 6-Wire Jumper
- 3) FDTI Port
- 4) USB to Mini USB
- 5) Computer
- 6) User Interface
- 7) 3-Wire Jumper
- 8) I2C Bus Hub
- 9) AirSpeed MicroSensor V3
- 10) VL6180 (Time of Flight) Sensor
- 11) GTPA010 (GPS) Sensor
- 12) MPL3115A2 (Altimeter) Sensor
- 13) 256 kbit EEPROM Chip
- 14) Battery Jumper
- 15) 9 V Battery

Test Setup:

For testing The Hornet telemetry system follow these steps. This setup is not meant to be installed on an aircraft. For aircraft installation, go to page _____.

- 1) Begin with the Arduino Mini Pro microcontroller.

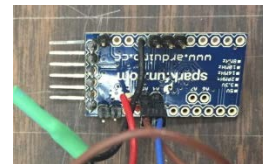


Figure 1: Arduino Mini Pro.

- 2) Connect the 6-Wire Jumper to the Arduino Mini Pro's BLK through GRN headers.



Figure 2: FDTI Jumper connected to the Arduino Mini Pro.

- 3) Then connect the FTDI Port to the other end of the 6-Wire Jumper. Make sure that the BLK ports of the Arduino Mini Pro and FTDI port are connected. The FTDI port and the Arduino Mini Pro's BLK-GRN headers should line up one-to-one.
- 4) Then take the USB to Mini USB cord and connect the mini USB to the FTDI port.



Figure 3: FTDI connection to Arduino Mini Pro.

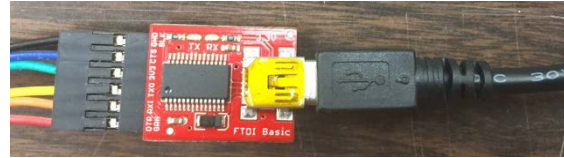


Figure 4: Mini USB to FTDI.

- 5) The USB end of the USB to Mini USB cord connects to any computer capable of running the Arduino IDE software.
- 6) Now place the User Interface board near the Arduino Mini Pro.

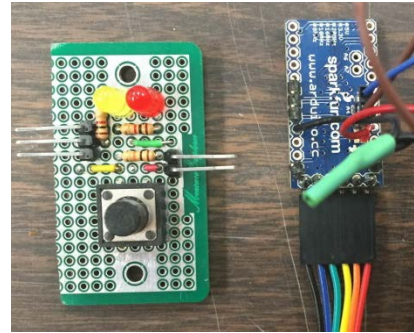


Figure 5: Arduino Mini Pro and User Interface board.

- 7) Take the 3-Wire Jumper and connect it to pins 2-4 on the Arduino Mini Pro. Note which color wire is connected to pin 2.

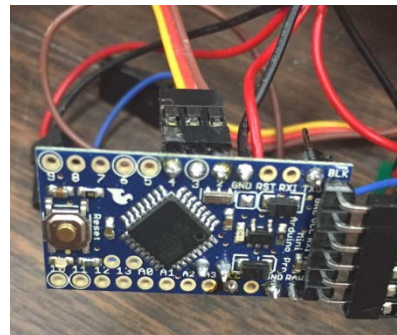


Figure 6: 3-Wire Jumper to Arduino Mini Pro.

- 8) Take the other end of the wire and connect it to the User Interface. Make sure that the pin 2 color wire is connected to the header closest to the yellow wire on the board as seen in Figure 8.

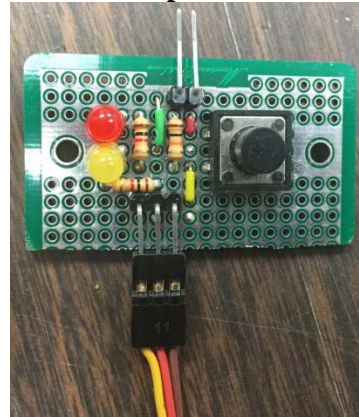


Figure 7: 3-Wire Jumper to User Interface.

- 9) The power connection for the User Interface is soldered to the Arduino Mini Pro. It is the 2-Wire female connections (red and black). Connect this to the User Interface board and insure that the red wire lines up with the small red wire on the User Interface board.

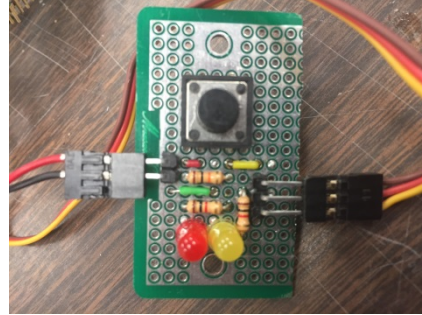


Figure 8: Power jumper to User Interface board.

- 10) Now we will set up the I2C Bus Hub which is already connected to the Arduino through soldered black, red, brown, and blue connections.

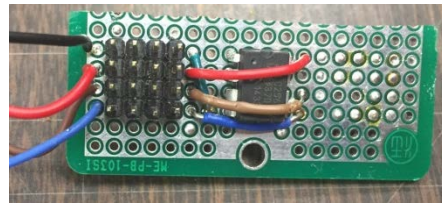


Figure 9: I2C Bus Hub.

- 11) Each of the four sensors (parts 9-12) have multicolored 4-wire jumpers connected to them. Each jumper is aligned to match the black, red, brown, and blue wires from the Arduino Mini Pro. Connect all four sensors such that the green wires all align with the black wire's row. Seen in Figure 11. It is important these rows to not cross as this will ruin the system.
- 12) Now connect the Battery Jumper connector to the Arduino Mini Pro's RAW and GND headers. Red to RAW and black to GND.

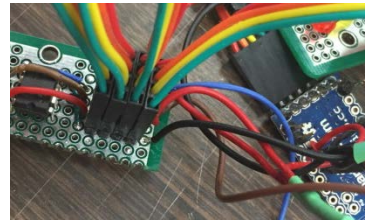


Figure 10: Sensors connected to I2C Bus Hub.

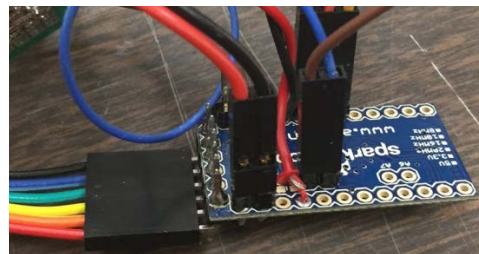


Figure 11: Battery Jumper connected to Arduino Mini Pro.

- 13) Now connect a 9 V battery to the Battery Jumper. A 9 V battery will only connect one way.

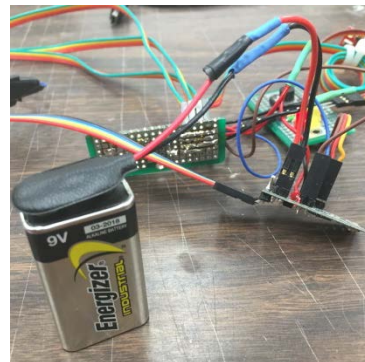


Figure 12: 9 V Battery connected.

Now that the hardware portion of The Hornet system has been assembled, upload the telemetryHornet Arduino Sketch. If you do not have the Arduino IDE software then visit this link:

<http://arduino.cc/en/Main/Software>. To upload this sketch follow these steps:

- 1) Open the telemetryHornet.ino file in the Arduino IDE software.
- 2) Select the correct Serial Port for the system that is connected to your computer. Note that this may be different depending on the type of computer you are using. For more information about Serial Ports visit <http://arduino.cc/en/Guide/Windows>
- 3) Select the correct Board next. Select: Arduino Pro or Pro Mini (3.3V, 8MHz) w/ ATmega328

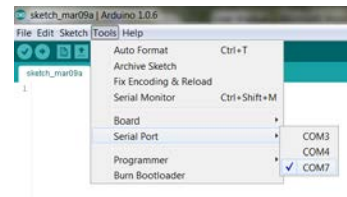


Figure 13: Serial Port selection.

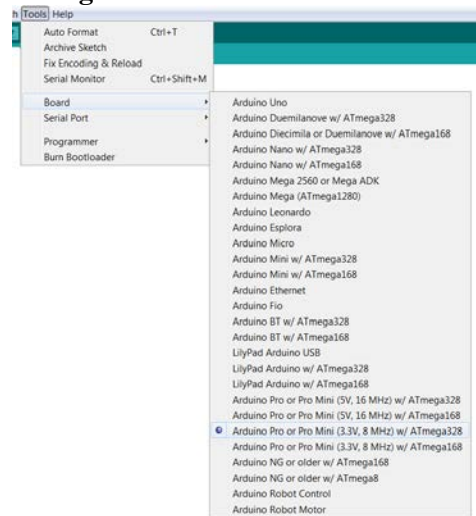


Figure 14: Board selection.

- 4) Upload the telemetryHornet sketch by pressing the upload button.

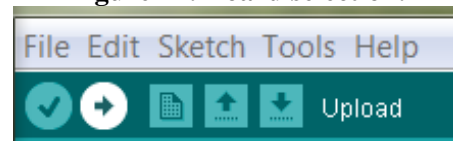


Figure 15: Upload the sketch.

- 5) Now open the Serial Monitor.

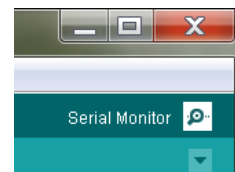


Figure 17: Serial Monitor.

- 6) Make sure the baud is set to 115200.

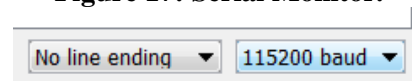
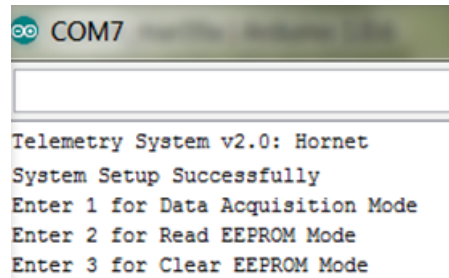


Figure 18: Setting the baud rate.

- 7) You should now see an output screen that matches Figure 20.



```
COM7  
Telemetry System v2.0: Hornet  
System Setup Successfully  
Enter 1 for Data Acquisition Mode  
Enter 2 for Read EEPROM Mode  
Enter 3 for Clear EEPROM Mode
```

Figure 19: Monitor output.

Enter a '1' to initiate the data acquisition system. The system will take a moment zero the altitude and then it will begin displaying data. Go to the troubleshooting section of the manual to confirm that the data is correct or if any issues have been encountered.

Aircraft Setup:

For installing The Hornet telemetry system in an aircraft make sure the following guidelines are noted. This installation will largely depend on the design of the aircraft but it is important to keep these guidelines in mind when installing this system.

- The airspeed sensor uses a Prandtl style pitot-static tube, pictured in Appendix J, which measures total pressure and static pressure to find air speed. The pitot-static tube must face directly forward to get an accurate measurement. Place the airspeed sensor inside the wing section normal to the leading edge and away from the propeller to avoid wash. Figure 21 demonstrates this technique.



Figure 20: Pitot-static tube in the wing section.

- The MPL3115A2 altimeter sensor also measures pressure to find a change in altitude. Keep this sensor away from the wash of the propeller and from any significant heat sources such as the battery and motor.
- The VL6180 Time of Flight sensor should be mounted on the bottom of the fuselage. Make sure that it has a clear line of sight to the ground. It uses IR and the delay of the reflection to determine distance, therefore any objects in its path, such as the landing gear, would make it inaccurate.
- The GTPA010 GPS communicates with satellites at 1575.42 MHz and is susceptible to interference from electronic devices, the motor in particular. Mount this sensor as far away from

the motor and electrical systems as reasonably possible and keep it as high as possible. As clear of a line of sight to the satellites as possible is also important but not entirely necessary.

- The User Interface board should be easily accessible for the system to be started or stopped. The LEDs are important indicators that allow the status of the system to be observed without a computer.
- The FDTI port must be accessible in order to read and clear the memory.

Appendices:

Appendix A: Arduino Mini Pro.



Appendix B: 6-Wire Jumper.



Appendix C: FDTI Port.



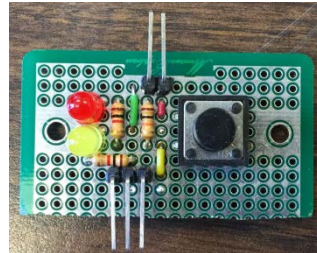
Appendix D: USB to Mini USB.



Appendix E: Computer with USB ports.



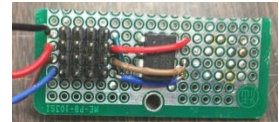
Appendix F: User Interface Board.



Appendix G: 3-Wire Jumper.



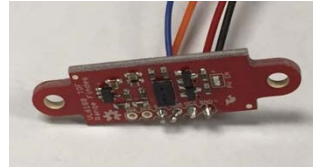
Appendix H: I2C Bus Hub.



Appendix J: AirSpeed MicroSensor V3.



Appendix K: VL6180.



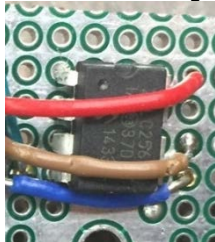
Appendix L: GTPA010.



Appendix M: MPL3115A2.



Appendix N: 256 kbit EEPROM Chip.



Appendix O: Battery Jumper.



Appendix P: 9 V Battery.

